CIVICSPARK CLIMATE ACTION PLAN 2016 METHODOLOGY

By Hoi-Fei Mok, CivicSpark at City of Emeryville 2015-2016

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1 ClearPath/GHG Inventory

The IPCC 4th Assessment was used for all the global warming potentials in the inventory. The 5th Assessment is available as well, with the 100 year and 20 year options to reflect the different global warming potentials of methane to CO2. If comparisons between the 4th and 5th Assessments are necessary, the 4th Assessment can used as default and once the inventory is completed, a copy of it can be made (at the Inventory home page under 'Edit Parameters') using the 5th Assessment calculations.

General notes for using ClearPath's inventory module:

- If you click "Information Only" under the Tags in the entry, it will NOT show up in your total GHG inventory. It will only show you the GHG output in the entry itself.
- If you do NOT answer "is this a previous value calculated", ClearPath will produce an error on the backend and give you a very small number for the output.
- Questions like how many households/businesses or people in the city are useful to answer if you want to calculate per capita emissions, but NOT necessary to get a ClearPath output.
- You can make more specific economic predictions with the fuel prices and net present value factor sets. While it IS necessary to have SOME numbers in this factor set, it is NOT necessary to have highly accurate fuel prices or NPV factor sets to move forward with the inventory.

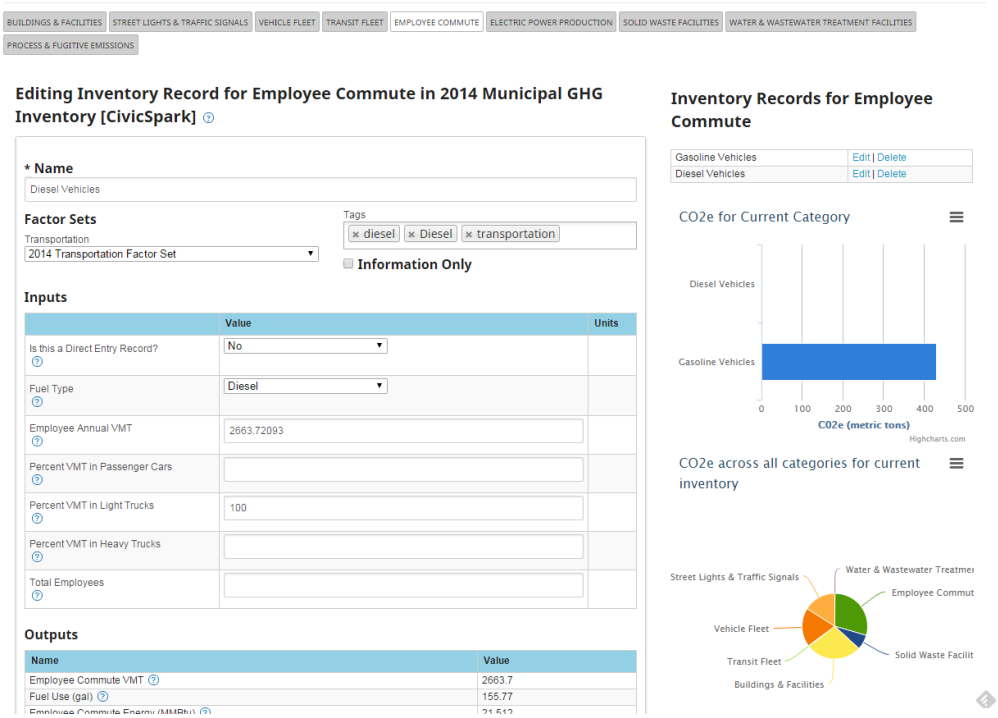
1.1 Municipal Inventory

1.1.1 Employee Commute

Employee commute survey was implemented in February 2016. See N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Transportation\Commute survey for copy of the survey and results. This can also be accessed in Google Forms here. Results were tallied up for the 'Every Day' option within each commute mode to calculate the proportion of employees and for split mode users, half week was assumed for driving/PT, driving/biking, biking/PT etc.

To calculate VMT, one way VMT was doubled and multiplied by 230 work days. ClearPath does not use fuel estimates for CO2 emission estimation in commutes, but that data is there in the spreadsheet as well. Within each fuel type, VMT for passenger cars, light trucks, and heavy trucks were summed up for all employees who responded driving every day. An average was calculated for the 4 employees who carpool and the VMT for all employees who have driving/PT or driving/biking was divided in 2 (assuming half week driving). Car data from employees who bike and/or PT was not counted. Then the total VMT was scaled up from the 43 (26%) survey responders to the full 166 (100%) employees in the city.

ClearPath does not allow for direct input of CO2/CH4/N2O emissions factors in employee commute, so the 2010 ClearPath 101 factors were used instead (in the Factors set tab). Separate entries should be made for gasoline and diesel because the CO2 emissions factors are different for the fuel types.



Screenshot of employee commute/diesel

1.1.2 Fleet Vehicles

Fleet vehicle emissions are calculated by fuel usage (gallons) or VMT. Emeryville does not keep track of VMT for its fleet, so fuel totals were used instead. Public works fleet fuel receipts came from Valorie Maxwell while other department fuel receipts were located at \\emery\department_data\Finance\Public\Fuel Purchases. Police fuel receipts were obtained from Eileen Burkeman from Finance. Paratransit fuel and VMT data came from Karen Boggs (karen@graybowenscott.com).

Police fuel receipts were incomplete for the year. To estimate annual fleet use, the average monthly use was calculated for each of the reports and multiplied by 12.

Community services van was least utilized of the departments. Community Services uses a bank card to pay for gas, instead of a gas card. Fuel amounts cannot be determined because bank card invoices record many types of purchases. To calculate vehicle fuel usage, assume Community Services spent $400 in 2013 for gas (or other number estimated from receipts/budget) and assume gas cost $3.88 a gallon. Source: http://www.energyalmanac.ca.gov/gasoline/retail_gasoline_prices2.html#2013

Off road equipment was not accounted for due to lack of data from the city on equipment.

1.1.3 Contractor Services

Emeryville contracts out for waste hauling (Waste Management INC), landscaping (New Images Landscaping), and street cleaning/sweeper use (Clean Streets). Fuel usage by contractors is Scope 3 under Compact of Mayors, but should be included in the inventory.

Waste Management: Ben Collins @ collins@wm.com (Albany, Emeryville, San Ramon)

New Images Landscaping: info@newimagelandscape.com

Clean Streets: Carl Grimes, cgrimes@cleanstreets.com

There has been no response for updated data for 2014 inventory, therefore 2010 data was used instead. The 2010 data included fuel usage for the WMAC waste trucks, the landscaping equipment, and street cleaner vehicles.

1.1.4 Electricity Data

PG&E's 2014 municipal inventory was used as the raw data. Some of the addresses/meters were not labeled, so the 2010 GHG inventory was used to cross reference the missing addresses. The updated list can be found in the Emeryville 2014 Municipal Master Data Workbook (N:\Public_Works\Public\Environmental Programs\Climate Action Plan\GHG Inventories\2014 Working Files) or in the Emeryville PG&E account list_04062016 file (N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Energy\2015 PGE). This accounts for building/facilities, street lights/traffic signals, and irrigation pumps.

The same electricity emission factors from PG&E were used for the municipal and community inventories. The latest PG&E CO2 emissions factor can be found at the Climate Registry. PG&E does not generate N2O or CH4 emissions factors. JR Kiligrew writes: "As far as the N2O and CH4, those are static and not produced by the utility so we recommend using the CEC figures or EPA California region emission factors which are available in the user guide and in each of the older PG&E factor sets in ClearPath." In lieu of more updated data, the 2010 N2O and CH4 emission factors were used for the 2014 inventory.

1.1.5 Fugitive Emissions

Refrigerant and coolant usage was collected from the HVAC, refrigerators, and coke machines in city facilities. The 2010 inventory intern was assisted by Clint White, maintenance general contractor for the city from Integrity Construction Maintenance. I reached out to Richard Cunningham for an updated list, he pointed me to Jodi Clark, but still waiting for updated data and using 2010 data in the meantime. Rich said that HVAC will definitely have updated data, but the smaller appliances probably not, unless you use industry standards. However, ClearPath does not include GHG conversions for all refrigerants so may need additional research.

2016 data for city refrigerant usage was obtained from Jody Clarke at Integrity (coetech@icmconstruction.com).

1.1.6 Solid Waste

Waste data from Waste Management Inc came from Marcy Greenhut. The WMAC datasheet already converted weight/volume. Assumed in ClearPath that methane capture was used at the landfill site.

The waste factor set came from StopWaste's 2008 Alameda County waste characterization study. Each city in Alameda County had specific waste breakdowns. The alternative study to use is the 2008

CalRecycle statewide waste study, but this is state wide whereas the StopWaste study is city-specific for Emeryville.

NOTE from 8/4/16, Mike Steinhoff of ClearPath:

Dear ClearPath User,

I have been reviewing data in ClearPath and found an unfortunate combination of data in Waste Generation records and the related Waste Characterization Factor Set used to calculate emissions. I also recognize that poor design has a role to play in this situation. The inputs for the Waste Characterization Factor Set mirrors that of the underlying emissions factors from the US Community Protocol, Table SW.5 (attached). These factors are broken out by the individual components of the waste as well as a summary factor for "Mixed MSW" which represents the national average composition of municipal solid waste. While this design is noted in the User Guide, I recognize the poor design in that it is not obvious how the calculator works to make calculations based on 100% mixed MSW or the individual waste components broken out.

From my review of your records, it appears that the Waste Characterization Factor Set you've applied has used the Mixed MSW category to represent the remainder inert portion of your waste stream. The result is an overestimation of emissions for your records. I've pulled the records and performed an analysis to estimate the size of the discrepancy for each impacted record and the inventory it is part off. I did the analysis using a methane global warming potential of 25 (4th Assessment 100 year value). The Highlighted column of the attached spreadsheet is roughly reduction in emissions that you should expect to see when the error is corrected.

In order to ensure that all affected users are notified before I change their data, I plan to implement a fix during system downtime over the weekend of the 13th. The change will re-route the calculation to not include the mixed MSW category in your records and update the outputs accordingly. You need to do nothing for this change. However this fix will only correct the outputs, for the time being the percent Mixed MSW in your record will remain the same; though will no longer be used in any calculation, except in cases where the value is 100%. You are of course welcome to make the change to the factor set on your own and re-save the affected records to update the outputs.

Please accept my apologies for the confusion and the poor design. I am relieved that only a small number of ClearPath users are affected and that we are able to pro-actively identify these kinds of errors and address them across all users consistently. I realize having to re-state emissions after the fact is not welcome news; however it should be some consolation that in this case the results of your inventory will be lower than previously calculated.

Please do not hesitate to reach out if you have any questions or concerns.

Regards,

Mike Steinhoff
Program Director, Tools and Technical Innovation

The GHG inventory records (GHG inventory comparisons file + CAP 2.0 file) have been updated accordingly to reflect this change.

1.2 Community Inventory

1.2.1 Transportation

Data came from Harold Brazil (HBrazil@mtc.ca.gov) at MTC (on-road commercial vehicle model and non-commercial vehicle model), EMFAC (buses, emissions factor), Katie Van Dyke (kvandyke@ci.berkeley.ca.us) from City of Berkeley (Berkeley's commercial vehicles gasoline/diesel fuel breakdown), Norman Wong (nwong@bart.gov) from BART (BART overall emissions for Emeryville's proportion), and Jim Allison (jalliso@bart.gov) from Amtrak (Capitol Corridor and San Joaquin line emissions at Emeryville's station). The TravelOne VMT data can be accessed online here. The following methodology was utilized in the 2010 GHG inventory by StopWaste, except the bus methodology. The bus VMT methods for 2014 come from Oakland's GHG inventory via Naomi Wentiworth – the 2010 inventory used a different method relying on county-wide EMFAC data rather than AC transit data.

Off-road vehicle data came from the 2010 GHG inventory. The Air Resources Board had recently switched over from OFFROAD2007 to more equipment specific models (marine vessels, refrigeration transportation units, construction equipment, etc), with OFFROAD2007 as a default for those sectors without inventories developed yet. However, of the off-road models available, the outputs generated do not include units. Since the variability between tons/days and tons/years is quite large, it was decided not to move forward with this data until units were confirmed. ARB has not responded on the model units and OFFROAD2007 was unable to generate data for 2014 (the model theoretically can produce results beyond 2014, but the output came out empty). In lieu of better data, the 2010 data for off-road equipment was used for the 2014 inventory. Given that off-road equipment was only 4% of the transportation sector emissions from 2010, it seems reasonable to move on until more information about the models is available.

Waterborne transport was not reported separately because it was included in the OffRoad2007 model outputs.

A summary table from Miya Kitahara, StopWaste on transportation methods:

Item	**Methodology / what's included**	**Activity**	**Emissions Factor(s)**	**County-level help**
On-road passenger vehicles (II.1)	Trips that start AND end in City plus 50% of trips that start OR end in City	VMT trip demand model Can access data here	EMFAC CO2 emissions per mile CH4+N2O	Get each model from MTC Create spreadsheet with

			emissions per mile	EF's x VMT
On-road freight (II.1)	% of county-wide modeled truck VMT, allocated by freight-related jobs **although ICLEI says we should try to find a better method**	VMT (from MTC) % of freight-jobs (LEHD)	Supplied by MTC (used EMFAC factors)	Get total VMT from MTC Calculate % distribution of jobs for each city
AC Transit (II.1)	% of system-wide emissions allocated by ridership	Ridership (population or boardings)	Total emissions for system	Get total emissions from AC Transit Calculate % share of ridership for each city
BART and Amtrak (II.2)	Train-miles traveled on track within City IF there is a station in City	Trains on tracks (from BART and Amtrak?) Miles of track in City	Total emissions for system divided by total train-miles	Get system data & calculate EF's Map track miles per city and get train counts per line
Waterborne (II.3) and Aviation (II.4)	Report as NE or C. In theory, trips that start AND end in City only			

NOTE 8/4/16: ICLEI has updated transportation methodology for BART, airports, and waterborne vehicles. BART has two different methodology possibilities, a Scope 3 and Scope 2 option. The Scope 2 option only applies to the jurisdictions with BART stations in their boundaries (calculating the electricity usage from operations, electricity emissions factor still to be determined). The Scope 3 option involves station-origin destination pairs and distances to create passenger miles traveled per station. This is then attributed to cities using the station exit survey data. This is more sophisticated than the current BART method, which only uses station exit data and population to proportion out the overall GHG emissions as calculated by BART.

Emissions from waterborne vehicles (scope 1) utilize a 2009 boating survey that includes fuel usage etc. This is low quality data at the county level that is proportioned out to cities by slip length and only includes marine/ports, not lakes. However, it can be used as a spaceholder for marine/pleasure craft emission until more updated data is available. Since Emeryville was using OffRoad2007 model for off-

road emissions, that modeling already included pleasure craft so it was unnecessary to double count this sector emissions separately. But when the next inventory is done and more updated off road data/modeling is available, we can switch to the 2009 boating survey data.

1.2.1.1 On-Road Vehicles – Emissions Factors

Instructions below for calculating the emissions factors are located in the ndrive under N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Transportation\Factor Set Calc.

ICLEI INSTRUCTIONS ON TRANSPORTATION EMISSION FACTOR CALCULATIONS

Part 1: Community Vehicle Miles Traveled

1. Request a community specific total VMT from your local transportation planning commission authority if you are a city, town or village and if you are a county, request the total VMT associated within County specific roads.

Part 2: Locating and retrieve EMFAC emissions from the County to be applied your community

2. Visit EMFAC Emissions Database
3. Data Type: mark Emissions Rates
4. Region: County (County your jurisdiction is in)
5. Calendar Year: Select Inventory Year
6. Season: Select Annual Average
7. Model Year: Aggregated
8. Speed: Aggregated
9. Fuel: Gas or Diesel

You will want to download each CSV file for each fuel type to help separate your future SEEC ClearPath transportation entries.

A CSV file will download for the selected County

Part 3: Data Conditioning of EMFAC CSV File for County Emissions

1. Open the CSV File
2. Highlight Column C (Vehicle Class), Column H (VMT (miles/day) and Columns AJ (CO2_RUNEX)

Note: Row Header explanations

- CO2_RUNEX: Emissions from vehicle in motion
- CO2_IDLEX: Emissions from vehicle while idling
- CO2_STREX: Emissions from vehicle ignition

3. Sum VMT (miles/day) for all vehicle types by each individual fuel type: gasoline or diesel
4. Create a new column next to Column H and label it % Daily VMT and then divide vehicle type VMT / total daily VMT for each vehicle type. This will be the Weighted % Daily Average VMT

5. Create a new column next to Column AE and label it CO2 weighted avg g/mile and you multiply each vehicle type CO2 RUNEX g/mile by the vehicle type % daily VMT to get the weighted average.
6. Sum up column CO2 weighted avg g/mile to calculate your new CO2 g/mile emission factor
7. Following the same steps for the remaining fuel type

You will now have a combined vehicle class Grams of CO_2 Per VMT to be applied to your city and/or county specific VMT breakdown.

Table TR.1.4 (Page 72 - Appendix D - Transportation) has default emission factors per VMT for N_20 and CH_4 Emission Factors for Passenger Cars

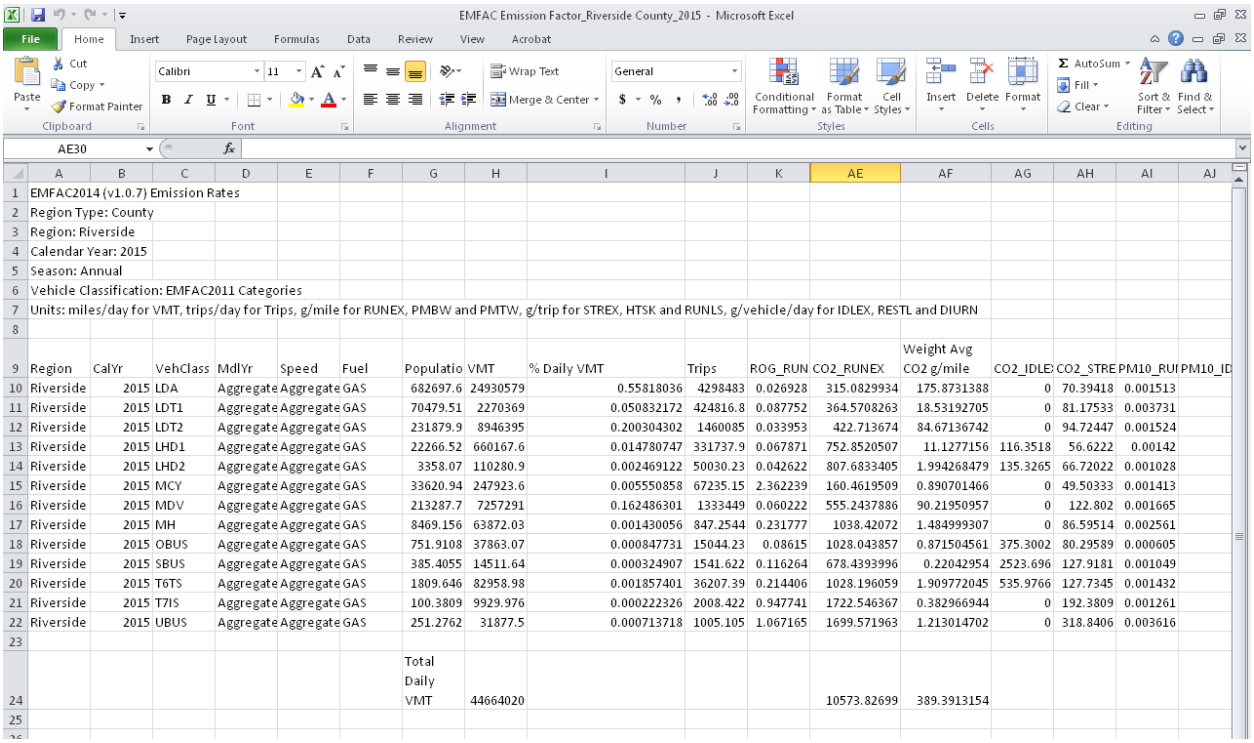
Table TR.2.2 (Page 74 – Appendix D – Transportation) has default emission factors per VMT for N_20 and CH_4 for Heavy Duty/Freight Trucks

Appendix found here: http://icleiusa.org/publications/us-community-protocol/

NOTE: At the moment, accounting for idling and start emissions is not recommended for the CO2 emission factor for VMT data. It is up to the local government to capture the start and idle emissions at their own discretion and applicability to their community inventory.

'Emissions Rates', not 'Emissions', should be selected on the EMFAC website as 'Emissions' generates the emissions inventory. Although electric vehicles are an option, the CO2 listed in the file was 0, so only gasoline and diesel vehicles were included in the transportation sector calculation. Since the CO2 emissions factors are different for gasoline and diesel, VMT for gasoline and diesel vehicles should be calculated separately as the associated CO2 will be weighted differently.

The same gas and diesel emission factors were used for passenger and commercial vehicles for Emeryville's 2004, 2010, and 2014 inventories. It is possible to get a more specific emissions factor for each vehicle type in EMFAC. However, this may require a regional agency like StopWaste or ICLEI to standardize.



EMFAC Emission Factor_Riverside County_2015 - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	AE	AF	AG	AH	AI	AJ
1	EMFAC2014 (v1.0.7) Emission Rates																
2	Region Type: County																
3	Region: Riverside																
4	Calendar Year: 2015																
5	Season: Annual																
6	Vehicle Classification: EMFAC2011 Categories																
7	Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN																
8																	
9	Region	CalYr	VehClass	MdlYr	Speed	Fuel	Populatio	VMT	% Daily VMT	Trips	ROG_RUN	CO2_RUNEX	Weight Avg CO2 g/mile	CO2_IDLE	CO2_STRE	PM10_RU	PM10_ID
10	Riverside	2015	LDA	Aggregate	Aggregate	GAS	682697.6	24930579	0.55818036	4298483	0.026928	315.0829934	175.8731388	0	70.39418	0.001513	
11	Riverside	2015	LDT1	Aggregate	Aggregate	GAS	70479.51	2270369	0.050832172	424816.8	0.087752	364.5708263	18.53192705	0	81.17533	0.003731	
12	Riverside	2015	LDT2	Aggregate	Aggregate	GAS	231879.9	8946395	0.200304302	1460085	0.033953	422.713674	84.67136742	0	94.72447	0.001524	
13	Riverside	2015	LHD1	Aggregate	Aggregate	GAS	22266.52	660167.6	0.014780747	331737.9	0.067871	752.8520507	11.1277156	116.3518	56.6222	0.00142	
14	Riverside	2015	LHD2	Aggregate	Aggregate	GAS	3358.07	110280.9	0.002469122	50030.23	0.042622	807.6833405	1.994268479	135.3265	66.72022	0.001028	
15	Riverside	2015	MCY	Aggregate	Aggregate	GAS	33620.94	247923.6	0.005550858	67235.15	2.362239	160.4619509	0.890701466	0	49.50333	0.001413	
16	Riverside	2015	MDV	Aggregate	Aggregate	GAS	213287.7	7257291	0.162486301	1333449	0.060222	555.2437886	90.21950957	0	122.802	0.001665	
17	Riverside	2015	MH	Aggregate	Aggregate	GAS	8469.156	63872.03	0.001430056	847.2544	0.231777	1038.42072	1.484999307	0	86.59514	0.002561	
18	Riverside	2015	OBUS	Aggregate	Aggregate	GAS	751.9108	37863.07	0.000847731	15044.23	0.08615	1028.043857	0.871504561	375.3002	80.29589	0.000605	
19	Riverside	2015	SBUS	Aggregate	Aggregate	GAS	385.4055	14511.64	0.000324907	1541.622	0.116264	678.4393996	0.22042954	2523.696	127.9181	0.001049	
20	Riverside	2015	T6TS	Aggregate	Aggregate	GAS	1809.646	82958.98	0.001857401	36207.39	0.214406	1028.196059	1.909772045	535.9766	127.7345	0.001432	
21	Riverside	2015	T7IS	Aggregate	Aggregate	GAS	100.3809	9929.976	0.000222326	2008.422	0.947741	1722.546367	0.382966944	0	192.3809	0.001261	
22	Riverside	2015	UBUS	Aggregate	Aggregate	GAS	251.2762	31877.5	0.000713718	1005.105	1.067165	1699.571963	1.213014702	0	318.8406	0.003616	
23																	
24							Total Daily VMT	44664020				10573.82699	389.3913154				
25																	

Example of CO2 emissions/gasoline factor calculation for Riverside

1.2.1.2 On-Road Vehicles – Commercial

Harold Brazil provided the results from the commercial vehicle model (total VMT for heavy trucks in Emeryville). Assume that the commercial vehicle fuel breakdown is the same as Berkeley's (as done in the 2010 GHG inventory) and use their commercial VMT fuel breakdown to get the proportion breakdown for Emeryville. Each proportion was calculated by dividing gasoline or diesel VMT by the total VMT.

Commercial Vehicle VMT sent by Harold Brazil, 12/16/15

Berkeley breakdown of fuel type for commercial vehicles, use for all cities. Sent by Katie Van Dyke (kvandyke@ci.berkeley.ca.us) and Sarah Moore with City of Berkeley, 12/31/15
Data from Harold Brazil in MTC based on their Travel Model One and Longitudinal Employer-Household Dynamics (LEHD) assumptions

Gasoline (commercial vehicle analysis)	**2000**	**2010**	**2014**	
Annual Berkeley Commercial Vehicle VMT, gasoline (Travel One Model	7,603,779	18,029,405	16,683,001	0.273414685
EMFAC2011 gasoline CO2 rate (grams/mile)	414	430	391	% of gasoline in commercial mix
EMFAC gasoline N2O rate (grams/mile)	0.07	0.07	0.07	
EMFAC gasoline CH4 rate (grams/mile)	0.06	0.06	0.06	
Fuel efficiency (miles/gallon gasoline) (EMFAC2011)	19.6	19.4	19.6	
CO2 (metric tons)	3,147	7,751	6,516	
N2O (metric tons)	1	1	1	
CH4 (metric tons)	0	1	1	
CO2e (metric tons) [CO2+310*N2O+21*CH4]	3,322	8,166	6,899	
Gasoline (gallons)	387,941	929,897	851,695	
Average CO2e (metric ton)/commercial vehicle gasoline (gallon)	0.00856	0.00878	0.0081	
Diesel (commercial vehicle analysis)	**2000**	**2010**	**2014**	
Annual Berkeley Commercial Vehicle VMT, diesel (Travel One Model)	38,120,374	41,271,529	44,334,208	0.726585315
EMFAC2011 diesel CO2 rate (grams/mile)	1,569	1,450	1,454	% of diesel in commercial mix
EMFAC diesel N2O rate (grams/mile)	0.05	0.05	0.05	
EMFAC diesel CH4 rate (grams/mile)	0.04	0.04	0.04	
Fuel efficiency (miles/gallon) (EMFAC2011)	6.4	6.9	6.8	
CO2 (metric tons)	59,812	59,857	64,444	
N2O (metric tons)	2	2	2	
CH4 (metric tons)	2	2	2	
CO2e (metric tons) [CO2+310*N2O+21*CH4]	60,437	60,533	65,170	
Diesel (gallons)	5,933,712	5,938,502	6,528,973	
Average CO2e (metric ton)/commercial vehicle diesel (gallon)	0.01019	0.01019	0.00998	

Screencap from the 2014 On Road Raw Data tab in the 2014 Community Master Workbook

1.2.1.3 On-Road Vehicles – Non-Commercial

Harold Brazil provided the results for the non-commercial vehicle model (total VMT for passenger, light/medium trucks, motor homes, and motorcycles). The fuel breakdown for these vehicles is given by EMFAC's 2014 emissions inventory for Alameda County (NOTE different from emissions rate file used for emissions factor calculation). First, sum up the VMT without the bus data (because the MTC model does not include buses). Then calculate the fuel proportions based on this total VMT. This will determine the overall gasoline/diesel breakdown for non-commercial vehicles outside of buses, based on MTC's model output.

Fuel breakdown for Passenger Vehicles, Light and Medium Trucks, Motor Homes, and Motorcycles (data from EMFAC)

Passenger vehic	diesel	0.004976971
	gasoline	0.577433027
Light and Mediu	diesel	0.013740494
	gasoline	0.396097029
Heavy trucks (m	diesel	0.000892915
	gasoline	0.000799453
Motorcycles	gasoline	0.006060112

Total fuel breakdown for passenger vehicles		
Gas	98.03896198	124,466,188.27
Diesel	1.961038024	2,489,652.31
Total	100	126955840.6
	%	total annual VMT

1.2.1.4 On-Road Vehicles - Buses

To calculate bus emissions, see methodology below from Naomi Wentworth at City of Oakland.

Need VMT, Fuel Use, and Passenger Boardings for ICLEI.

VMT & Boardings:

Source: National Transit Database forms show Annual VMT & boardings of each transit system

(use annual revenue miles, not passenger miles for VMT and unlinked trips for boardings)

AC Transit: http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2013/agency_profiles/9014.pdf

Parent site with all transit/years: (http://www.ntdprogram.gov/ntdprogram/data.htm)

Fuel Use: http://www.apta.com/resources/statistics/Pages/NTDDataTables.aspx

Attribute a percentage of service to Emeryville. This site show there are 1.5 million people in the service area: http://www.actransit.org/about-us/facts-and-figures/ridership/

Then take the percentage of the population of Emeryville to the full AC Transit service population and attribute that percent of fuel use / boardings / VMT to the calc.

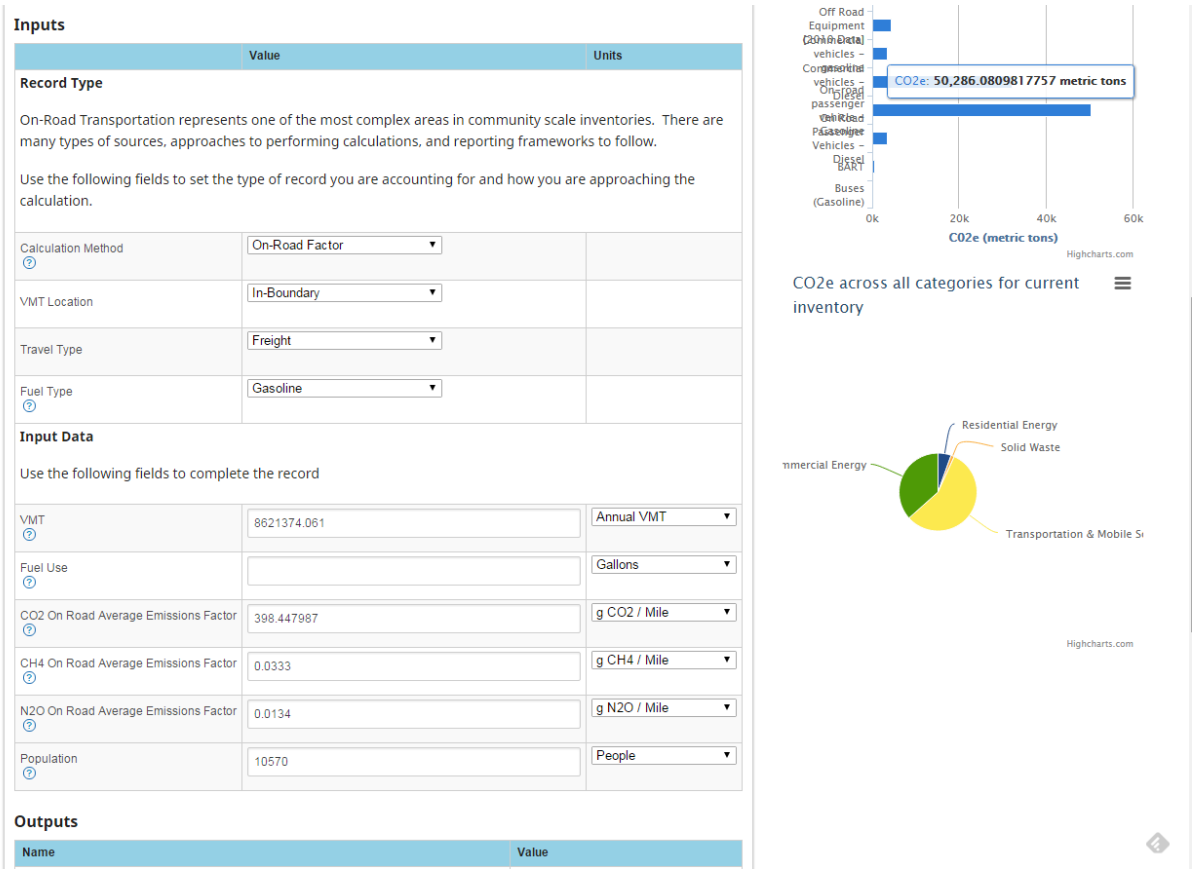
When the bus VMT was calculated for Emeryville in the 2014 inventory, there was a small proportion (0.31%) of bus VMT that came from hydrogen fuel. However, there is no emissions factor available for hydrogen fuel. Therefore, it was decided to overestimate the emissions from this small proportion and combine the VMT with the gasoline section.

1.2.1.5 On-Road Vehicles – General

In total, there should be 6 different VMT totals for on-road transportation: commercial vehicles (gasoline and diesel), non-commercial vehicles (gasoline and diesel), and all buses (gasoline and diesel). These are Scope 1 emissions (Scope 3 is included).

See calculations as listed in the 2014 Community Master Work Book at N:\Public_Works\Public\Environmental Programs\Climate Action Plan\GHG Inventories\2014 Working Files

Within ClearPath, you can use the On Road Factor calculation method and the VMT data + CO2 emissions factors to calculate the emissions. Fuel data is not required if VMT is provided. The VMT/MPG method should give similar results, but requires MPG (no data source for that) and vehicle breakdown percentage. Emissions factors are calculated through EMFAC and the ClearPath101 reference guide (for NO2 and CH4). ClearPath has recently had issue with the transportation factor set, so make sure you have filled out the factor set for each vehicle type. Use the EMFAC/ClearPath 101 factors. A more updated source for MPGs could not be found, so the defaults in ClearPath were used instead.



Screenshot of Commercial Vehicles/Gasoline input for ClearPath

1.2.1.6 State Highway

State highway contribution to Emeryville's transportation emissions (MTC data) was assumed to be 58%, which is the highway contribution to Alameda County's transportation emissions as found in CA Public Roads and Highways Data document. This was calculated from Table 6, page 16; State Highway VMT/Total Alameda County VMT. See document here: N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Transportation\On Road Vehicles

Therefore, local traffic will be 42% of on-road transportation (commercial, non-commercial, buses). Amtrak, BART, and off-road emissions will remain the same.

Table 6

2013 Maintained Mileage & Daily Vehicle Miles of Travel Estimates by Jurisdiction

COUNTY	JURISDICTION	MAINTAINED MILES RURAL	MAINTAINED MILES URBAN	MAINTAINED MILES TOTAL	DAILY VEHICLE MILES OF TRAVEL (DVMT) [1,000] RURAL	DAILY VEHICLE MILES OF TRAVEL (DVMT) [1,000] URBAN	DAILY VEHICLE MILES OF TRAVEL (DVMT) [1,000] TOTAL
ALAMEDA							
Cities:	ALAMEDA		129.14	129.14		533.06	533.06
	ALBANY		26.13	26.13		121.32	121.32
	BERKELEY		224.21	224.21		905.77	905.77
	DUBLIN	16.80	49.47	66.27	5.88	313.67	319.55
	EMERYVILLE		20.63	20.63		88.19	88.19
	FREMONT	0.48	493.16	493.64	0.17	1,639.18	1,639.35
	HAYWARD	11.64	261.74	273.38	4.22	1,372.47	1,376.69
	LIVERMORE	6.79	284.36	291.15	2.38	1,366.99	1,369.37
	NEWARK		109.31	109.31		665.63	665.63
	OAKLAND	0.10	885.82	885.92	0.04	4,614.69	4,614.72
	PIEDMONT		44.00	44.00		102.76	102.76
	PLEASANTON	2.06	224.96	227.02	27.69	1,421.03	1,448.72
	SAN LEANDRO		183.77	183.77		1,077.10	1,077.10
	UNION CITY	8.51	145.38	153.89	2.98	516.31	519.29
Other:	ALAMEDA COUNTY	91.76	402.49	494.24	148.66	1,847.48	1,996.14
	ARMY CORPS OF ENGINEERS		0.24	0.24		0.12	0.12
	DEPARTMENT OF ENERGY		0.25	0.25		0.21	0.21
	PORT OF OAKLAND		0.40	0.40		0.48	0.48
	STATE HIGHWAYS	24.03	180.87	204.90	2,335.84	21,014.92	23,350.76
	STATE PARK SERVICE	1.00		1.00	0.09		0.09
	U.S. ARMY		0.67	0.67		0.43	0.43
	U.S. NAVY		153.60	153.60		99.07	99.07
	UNIVERSITY OF CALIFORNIA		0.49	0.49		14.36	14.36
	US FISH & WILDLIFE SERVICE	3.28		3.28	0.10		0.10
ALAMEDA TOTAL		**166.44**	**3,821.07**	**3,987.52**	**2,528.04**	**37,715.24**	**40,243.28**

Table 6 from CA Public Roads and Highways 2013; State Highways VMT is highlighted

1.2.1.7 Amtrak

Emissions were calculated for train travel time within Emeryville boundaries and for idling time. Engine information and fuel economy was provided by Jim Allison, CCJPA, Manager of Planning, Amtrak as 70 gallons diesel/hour for average fuel consumption. Total annual minutes of train operation between and at each station in Alameda County on the Capitol Corridor and San Joaquin lines were calculated based on published schedule data. This was then converted to gallons of diesel using average fuel consumption. Fuel consumed while idling at a station was allocated to the city containing that station. Next, Google Maps' Distance Measurement Tool was used to estimate the length of track within each city boundary per segment and calculate the percentage within each city. Each city was then allocated the corresponding percentage of emissions from that segment. Weekend and holidays were taken from the federal holiday calendar.

A detailed breakdown of the calculations and schedules can be found in the ndrive here: N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Transportation\Amtrak or in the 2014 Community Master Data Workbook

In ClearPath, this was entered as Public Transit as Heavy Rail within the jurisdiction. Since we only counted travel within Emeryville boundary, this counts as Scope 1.

1.2.1.8 BART

BART overall emissions came from Norman Wong at BART while BART ridership data came from the BART website. Cities across the Bay Area all share in on BART emissions by the number of riders that exit from the stations and the city population. For Emeryville, that is Macarthur station. One eighth of Oakland's population and half of Piedmont's population (calculated by how many BART stations the city contributes towards/located by; Oakland has 8, Piedmont has 2) contributes to ridership at Macarthur. The total station population then contributing to ridership at Macarthur is Emeryville + Oakland/8 + Piedmont/2. The city ridership is calculated by station ridership x Emeryville's proportion in total station population (ie Emeryville population/total station population). The station emissions is calculated by (city ridership/sum of all city ridership across Bay Area) x overall BART emissions. The sum of all city ridership is used rather than the sum of station ridership (as provided by BART) so that it can account for each city's contribution. Therefore to calculate Emeryville's contribution, all city contributions across the Bay Area must be calculated as well.

A detailed breakdown of the BART emissions can be found on the ndrive here: N:\Public_Works\Public\Environmental Programs\Climate Action Plan\Transportation\BART or in the 2014 Community Master Data Workbook

In ClearPath, this was entered as direct CO2 entry for on-road transportation since public transit entry had no option for direct entry. This counts as scope 3.

1.2.1.9 Off Road Data

Off road models are available through the Air Resources Board here. OFFROAD2007 is being phased out in favor of more specific models for different equipment (marine vessels, refrigeration transportation units, etc). However, not all off road equipment currently has an inventory model available. ARB recommends using OFFROAD2007 to estimate GHG from those sectors.

Of the specific equipment models with inventories, not all clearly indicate what the units are for the output. The accompanying guides for the inventories do not include comprehensive output examples with units. Since the variability between tons/days and tons/years is quite large, it was decided not to move forward with this data until units were confirmed. ARB has not responded on the model units and OFFROAD2007 was unable to generate data for 2014 (the model theoretically can produce results beyond 2014, but the output came out empty). In lieu of better data, the 2010 data for off-road equipment was used for the 2014 inventory. For this reason, the 2010 data for the off road sector was used for Compact of Mayors reporting for 2014 until more accurate updated data can be accessed.

1.2.2 Electricity Data

Data came from PG&E's community inventory and accounts for residential and commercial electrical and natural gas use (non-gov for residential and commercial use).

The same electricity emission factors from PG&E were used for the municipal and community inventories. The latest PG&E CO2 emissions factor can be found at the Climate Registry. PG&E does not generate N2O or CH4 emissions factors. JR Kiligrew writes: "As far as the N2O and CH4, those are static and not produced by the utility so we recommend using the CEC figures or EPA California region

emission factors which are available in the user guide and in each of the older PG&E factor sets in ClearPath." In lieu of more updated data, the 2010 N2O and CH4 emission factors were used for the 2014 inventory.

Note from JR Kiligrew: the county has its own GHG reduction strategy, so no need to include county level data for electricity/gas. However, district level should be included because it's not guaranteed that districts account for their GHGs. City data (in the community inventory) should also be included. Under residential energy, Non Gov will be the only entry. But for Commercial, there will be Non Gov, City, and District.

1.2.3 Water and Wastewater

Best contacts for EBMUD data include Charles Bohling (charles.bohlig@ebmud.com) and Chris Dembiczak. Oakland provided their data and instructions, included EBMUD wide per capita potable water use, EBMUD wide per capita wastewater generation, and energy conversion factors (kwh/MG for potable water treatment, distribution, surface water conveyance, wastewater collection, wastewater treatment). Using Emeryville population, potable water consumption data, and PGE factor set, the scope 3 emissions from electricity usage was calculated. For the energy for surface water conveyance within water extraction emissions, the median value (3000 kWh/MG) was significantly higher than the actual value reported by EBMUD in 2013 (389 kWh/MG), so the reported value from 2013 was used for 2004 and 2010 inventories.

Water extraction emissions		Unit		
EBMUD-wide Per capita water use (in gpd)	163	gpd		
Total annual Emeryville water use	628.86	MG		
Energy used for groundwater extraction (kWh/MG)	0	kWh/MG	**Calculations**	
Energy used for surface water conveyance (kWh/MG)	389	kWh/MG	244627.38	kWh
Energy used for surface water treatment (kWh/MG)	155	kWh/MG	97473.633	kWh
Energy consumed per unit of distributed water (kWh/MG)	1,270	kWh/MG	640689.12	kWh
Total Emeryville potable water extraction energy			982790.12	kwh

Extract from the 2014 Community Master Data Workbook – Water Energy Raw Data

This methodology would give results that can be inputted in ClearPath under 'Emissions from Supply of Potable Water'. ClearPath also has options for tracking emissions from the N2O released from wastewater effluent discharge to rivers and estuaries, combustion of digester gas, and nitrification/denitrification of process N2O during the wastewater treatment process. This requires population data and an industrial commercial multiplier (ClearPath defaults to 1.25 – Emeryville has high proportion of commercial businesses so used 1.75), in lieu of direct nitrogen load wastewater quality data. EBMUD has an anaerobic digester with no nitrification/denitrification process.

Wastewater energy emissions (related to electricity usage, not the N2O generation) can be zeroed out because of the anaerobic digester at EBMUD generates all the energy used on site. For Emeryville's 2014 inventory, wastewater energy emissions were zeroed out for this reason. This is in accordance with the 2010 inventory where only fugitive emissions from wastewater were accounted for.

All water/wastewater emissions would be scope 3 because EBMUD facilities are located outside of Emeryville city boundaries in Oakland.

1.2.4 Solid Waste

CalRecycle data was used for the 2014 inventory. Although WMAC provides data direct from the source, the other inventories used CalRecycle and the values are comparable to the WM Inc values reported to the city. Additionally the CalRecycle data is more easily accessed here.

The waste factor set came from StopWaste's 2008 Alameda County waste characterization study. Each city in Alameda County had specific waste breakdowns. The alternative study to use is the 2008 CalRecycle statewide waste study, but this is state wide whereas the StopWaste study is city-specific for Emeryville.

NOTE from 8/4/16, Mike Steinhoff of ClearPath:

Dear ClearPath User,

I have been reviewing data in ClearPath and found an unfortunate combination of data in Waste Generation records and the related Waste Characterization Factor Set used to calculate emissions. I also recognize that poor design has a role to play in this situation. The inputs for the Waste Characterization Factor Set mirrors that of the underlying emissions factors from the US Community Protocol, Table SW.5 (attached). These factors are broken out by the individual components of the waste as well as a summary factor for "Mixed MSW" which represents the national average composition of municipal solid waste. While this design is noted in the User Guide, I recognize the poor design in that it is not obvious how the calculator works to make calculations based on 100% mixed MSW or the individual waste components broken out.

From my review of your records, it appears that the Waste Characterization Factor Set you've applied has used the Mixed MSW category to represent the remainder inert portion of your waste stream. The result is an overestimation of emissions for your records. I've pulled the records and performed an analysis to estimate the size of the discrepancy for each impacted record and the inventory it is part off. I did the analysis using a methane global warming potential of 25 (4th Assessment 100 year value). The Highlighted column of the attached spreadsheet is roughly reduction in emissions that you should expect to see when the error is corrected.

In order to ensure that all affected users are notified before I change their data, I plan to implement a fix during system downtime over the weekend of the 13th. The change will re-route the calculation to not include the mixed MSW category in your records and update the outputs accordingly. You need to do nothing for this change. However this fix will only correct the outputs, for the time being the percent

Mixed MSW in your record will remain the same; though will no longer be used in any calculation, except in cases where the value is 100%. You are of course welcome to make the change to the factor set on your own and re-save the affected records to update the outputs.

Please accept my apologies for the confusion and the poor design. I am relieved that only a small number of ClearPath users are affected and that we are able to pro-actively identify these kinds of errors and address them across all users consistently. I realize having to re-state emissions after the fact is not welcome news; however it should be some consolation that in this case the results of your inventory will be lower than previously calculated.

Please do not hesitate to reach out if you have any questions or concerns.

Regards,

Mike Steinhoff
Program Director, Tools and Technical Innovation
ICLEI-Local Governments for Sustainability USA
www.icleiusa.org

The GHG inventory records (GHG inventory comparisons file + CAP 2.0 file) have been updated accordingly to reflect this change.

1.3 ClearPath Reporting Module

This is a useful module for quick comparison/overview of the GHG inventory. Under 'Inventory Comparison by Sector', the following graph can be generated, comparing the outputs for all the official inventories in the program. This can be accessed for either Municipal or Community inventories.

There is also the option for viewing the 'Inventory by Scope and Sector', but because of the way some of the ClearPath sectors are structured and how the data was entered, not all of the entries may fall under the scope they should be in for Compact of Mayors. For example, in transportation, the BART entry could not be entered under Public Transit because there was no direct entry option. Therefore, it was easiest to go entry by entry in the inventory itself to copy the CO2 output for Compact of Mayors reporting, rather than to use the Reporting module for this purpose.

In the updated ClearPath version, the GPC report can be exported for upload to Compact of Mayors.

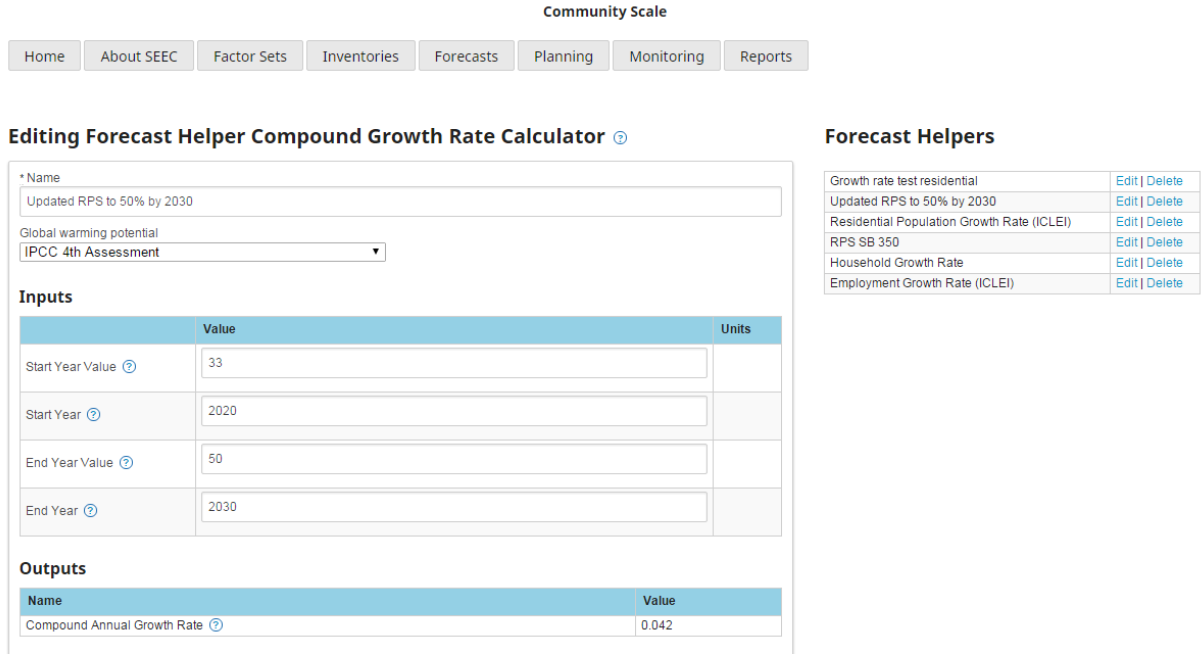
1.4 ClearPath Forecast Module

1.4.1 Forecast Helper Calculator

Before you can create any forecasts, you need the forecast growth parameters to set up the scenario. The Forecast Helper Calculator generates the compound annual growth rate parameter that's needed for the Forecast module.

Calculating the growth rate for households or employment is straightforward: you enter the start year (2010), starting value (5694 households), end year (2040), and ending value (11619 households), and the compound annual growth rate is the rate of growth for the households (0.024).

The calculator can also be used for the rate of change for other initiatives, such as the state's renewable portfolio standard. The state plans to scale up from 33% renewable to 50% renewable in the fuel standard by 2030; to implement this in the module, a growth rate parameter is needed. As with the household growth scenario, enter in start/end years and values, and the calculator will generate the annual growth rate for how fast the RPS scenario is implemented.



Numbers for Emeryville population and other growth factors can be found in the ClearPath Factor Set 2014 file in the ndrive here: N:\Public_Works\Public\Environmental Programs\Climate Action Plan\GHG Inventories\2014 Working Files

1.4.2 Creating Forecasts

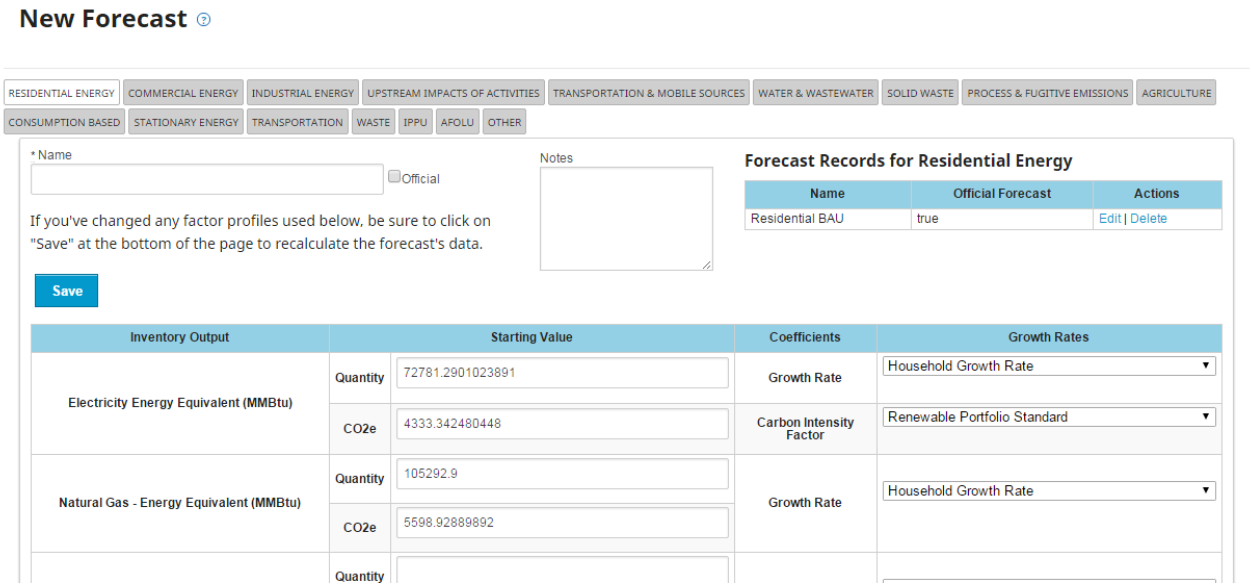
Creating the forecast requires that you have completed the inventory. Any changes made to the inventory will NOT be reflected in the forecast or planning modules, so it is best to wait to create the forecast/planning scenario until after everything in the inventory is finalized. The baseline inventory may not necessarily be the best inventory to start from because the growth rates may over or under estimate the actual emissions. In Emeryville's case, starting from the 2004 inventory causes the forecast module to overestimate emissions at 2010. Since Emeryville has 2010 and 2014 inventories, using those inventories for forecasts would more likely reflect the growth in emissions.

The forecast scenario ONLY creates the predictions for emissions growth (as estimated from household/employment growth) and does NOT take into account any climate initiatives implemented at the local level. All local reductions in emissions are modeled in the Planning module. HOWEVER, any STATE initiatives, such as the Renewable Portfolio Standard, do need to be included in the forecast scenario (see screenshot below for how this is included).

For Emeryville, there are several different scenarios:

1) Business As Usual (BAU) – no state implementation of RPS, includes state highway traffic
2) BAU[Local Traffic Only] – no state implementation of RPS, local traffic only
3) BAU with State Regulations – state implementation of RPS, state highway traffic
4) BAU with State Regulations [Local Traffic Only] – state implementation of RPS, local traffic only

The scenarios that involve local traffic only utilized inventories for local traffic only. The local traffic inventories are not official, but can still be used in the forecast module. Once the inventory is chosen for a new forecast, the CO2 outputs from the inventory will automatically populate each of the sectors in the module.



When you go through each sector, you need to select the growth rate for each component. For example, you can choose Household Growth for residential electricity and natural gas, or Employment Growth for commercial electricity and natural gas. For the carbon intensity factor, use Pavley II intensity factor to reflect changes in vehicle fuel efficiency or RPS growth to reflect changes in the electricity grid cleanliness. For waste and transportation, either Household or Employment growth can be used for the overall emissions growth. Each sector needs to be saved as an official forecast within the forecast scenario (Residential BAU, Commercial BAU, etc).

Once the individual sector is saved, ClearPath generates a graph showing the predicted emissions for that sector only (ie Residential electricity and natural gas only). However, you can only see the combined emissions from all the sectors together in the Planning scenario.

1.5 ClearPath Planning Module

1.5.1 Creating New Reduction Strategies

The reduction strategies are meant to reflect the local initiatives used to reduce emissions, such as increasing solar on residential or commercial roofs, low flow faucets, commercial building benchmarking etc. However, the way the strategies are currently set up is very inflexible. For example, the residential

energy conservation ordinance (RECO) only allows the strategy to be triggered via household sales, not by date certain or other triggers. The data required for some of the strategies is also very specific: square feet of commercial buildings for benchmarking in the city, number of low flow showerheads installed annually, total commercial electricity usage, etc. The list of strategies itself is also incomplete in the scope of what Emeryville/municipalities hope to implement.

Theoretically the open ended reduction strategy, User Defined Residential Energy or User Defined Transportation etc, can be used to create strategies not listed. It is implemented via a primary driver which is counted in some units; for example, a strategy could be selling X electric vehicles that reduce transportation emissions by X amount. Again, it only reflects a particular type of reduction strategy and requires some calculations on reductions/unit.

Therefore, this Planning module should not be used for complete GHG reduction planning, but rather a rough estimate of how much GHG we can expect in the future and for some select strategies, a rough idea of how much implementation is needed to get a significant reduction.

1.5.2 Creating New Planning Scenarios

To create a new Planning scenario, you must have already created a Forecast scenario (ie some growth forecast) to work from. As with above, the 4 main scenarios that Emeryville is looking at include:

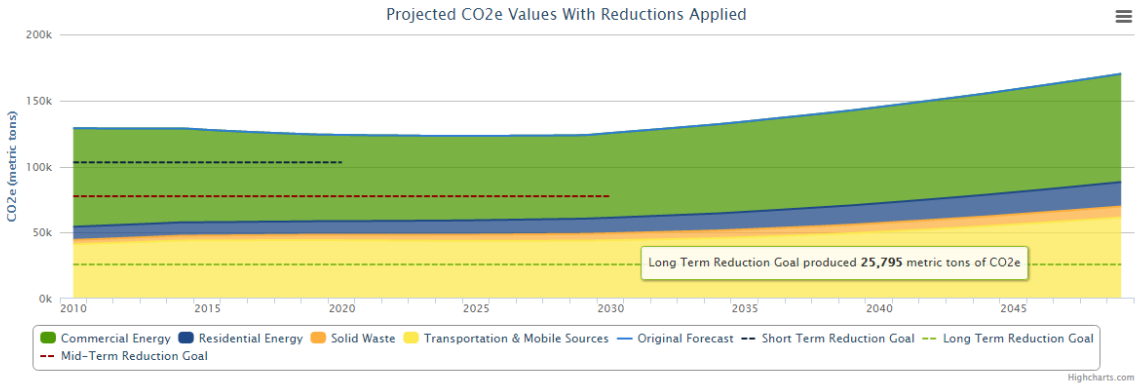
1) Business As Usual (BAU) – no state implementation of RPS, includes state highway traffic
2) BAU[Local Traffic Only] – no state implementation of RPS, local traffic only
3) Growth with RPS – state implementation of RPS, state highway traffic
4) Growth with RPS [Local Traffic Only] – state implementation of RPS, local traffic only

Reduction goals should be set – use the state targets (20% for 2020, 40% for 2030, 80% for 2050). These can be accessed at the Planning module home page and will be utilized for all the Planning scenarios.

Once a new Forecast scenario is made, you can add a reduction strategy to it. These need to be implemented over a period of time, so the decision to run an initiative over 20 years vs 40 years will change how much reduction impact it has. Remember to click the active button before saving.

Edit Planning Scenario

Export to CSV: Scenario Basics | Scenario Details | Reduction Measures



Add a new reduction measure:

Choose a reduction measure | Add

Measure Name	Actions	Start Year	End Year	Active
Residential EE Education Outreach HIGH	Edit | Remove	2016	2036	
Residental PV strategy HIGH	Edit | Remove	2016	2036	
BikeShare Infrastructure HIGH	Edit | Remove	2016	2036	
Low flow showerheads HIGH	Edit | Remove	2016	2036	
Low Flow Faucets HIGH	Edit | Remove	2016	2036	

2 Compact of Mayors Reporting

2.1 Requirements

The COM has 3 sections: the GHG inventory, the climate mitigation/action plan, and climate adaptation plan.

GHG Inventory Reporting Frequency

Table 2: Acceptable inventory date range

Inventory Year	Reporting year				
	2015	2016	2017	2018	2019
2011					
2012					
2013					
2014					
2015					
2016					
2017					
2018					

From the Compact of Mayors Definition of Compliance Guide

See the GPC for the inventory requirements.

During the off-years of not reporting the inventory, cities need to report a list of improvements made to the quality of their inventory, focusing both on data availability and data quality, and areas where outstanding data challenges exist.

The climate mitigation plan (action plan) must be submitted within 3 years of COM and updated/completed within 5 years.

Climate Mitigation Plan Min Requirements (Sections):

- Political commitment
- Vision describing city's overall ambition and clear objectives
- Context
- Baseline GHG emissions
- Business-as-usual GHG emissions forecast
- GHG emissions reduction target(s)
- Implementation plan
- Monitoring plan

The climate adaptation plan must also be submitted within 3 years of COM. It should incorporate a climate hazard reporting and climate vulnerability risk assessment.

Climate Adaptation Plan Min Requirements (Sections):

- Political commitment
- Actions to reduce the harm or exploit the benefits of expected climate change

- Cross-departmental engagement
- Mechanism for review

2.2 Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)

GPC is the official GHG inventory method. “The city-induced framework gives cities the option of selecting between two reporting levels: BASIC or BASIC+. The **BASIC level** covers scope 1 and scope 2 emissions from stationary energy and transportation, as well as scope 1 and scope 3 emissions from waste. **BASIC+** involves more challenging data collection and calculation processes, and additionally includes emissions from IPPU and AFOLU and transboundary transportation. Therefore, where these sources are significant and relevant for a city, the city should aim to report according to BASIC+. The sources covered in BASIC+ also align with sources required for national reporting in IPCC guidelines.” - Global Protocol for Community-Scale Greenhouse Gas Emission Inventories

Starting in year 3 of COM, cities will need to report CH4 and NO2 as well as CO2.

Figure 2 Sources and scopes covered by the GPC

Sectors and sub-sectors	Scope 1	Scope 2	Scope 3
STATIONARY ENERGY			
Residential buildings	✓	✓	✓
Commercial and Institutional buildings and facilities	✓	✓	✓
Manufacturing industries and construction	✓	✓	✓
Energy industries	✓	✓	✓
Energy generation supplied to the grid	✓		
Agriculture, forestry, and fishing activities	✓	✓	✓
Non-specified sources	✓	✓	✓
Fugitive emissions from mining, processing, storage, and transportation of coal	✓		
Fugitive emissions from oil and natural gas systems	✓		
TRANSPORTATION			
On-road	✓	✓	✓
Railways	✓	✓	✓
Waterborne navigation	✓	✓	✓
Aviation	✓	✓	✓
Off-road	✓	✓	
WASTE			
Disposal of solid waste generated in the city	✓		✓
Disposal of solid waste generated outside the city	✓		
Biological treatment of waste generated in the city	✓		✓
Biological treatment of waste generated outside the city	✓		
Incineration and open burning of waste generated in the city	✓		✓
Incineration and open burning of waste generated outside the city	✓		
Wastewater generated in the city	✓		✓
Wastewater generated outside the city	✓		
INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)			
Industrial processes	✓		
Product use	✓		
AGRICULTURE, FORESTRY, AND LAND USE (AFOLU)			
Livestock	✓		
Land	✓		
Other agriculture	✓		
OTHER SCOPE 3			
Other Scope 3			

✓ Sources covered by the GPC

Sources required for BASIC reporting

Sources required for BASIC+ reporting

Sources required for territorial total but not for BASIC/BASIC+ reporting (*italics*)

Sources included in Other Scope 3

Non-applicable emissions

2.2.1 Consumption Based Inventory

BAAQMD and UC Berkeley had created a consumption based inventory study for the Bay Area in 2015 with household level per capita emissions for each city. A *consumption-based* inventory includes the emissions resulting from all consumption activities of a local community of residents. It attributes all emissions to the end consumer, including all emissions released along the supply chain. This is in contrast to a *production-based* inventory, which attributes all emissions to the location where the emissions occur (for example on agricultural lands or at manufacturing facilities). Both are valid methods and it is useful to look at GHG emissions from both perspectives.

StopWaste has written up a chapter insert for cities interested in including the consumption based inventory in their CAPs. See Miya Kitahara for the file.

2.3 Climate Adaptation

StopWaste had funds to hire a consultant, 427 Climate Solutions, to do climate adaptation work for cities. Emeryville, Hayward, Fremont, and Piedmont were among the cities who asked for this service. 427 Climate Solutions will work over summer 2016 to create an asset vulnerability assessment (in the context of climate hazards, major ones being floods, heat waves, sea level rise, and drought in Emeryville) as well as a list of 20 actions that can be included in the CAP. The asset vulnerability assessment is based off of existing infrastructure and buildings in the city.

Emeryville's Local Hazard Mitigation Plan will also include a climate adaptation component (the CAP and LHMP are to be aligned in this area for FEMA funding), so the content created by 427 Climate Solutions will also be adapted for the LHMP.

2.4 CDP

CDP is an international non-profit organization that organizes the biggest global GHG emissions reporting mechanism. Since they also work with many private investors, companies, and governments, they can leverage a lot of change and networks. They are one of the two platforms for GHG reporting for Compact of Mayors (COM), the other being Carbonn.

PROS: Contributing to CDP means contributing to a global report of cities working on sustainability efforts in addition to meeting COM requirements. CDP may also be able to connect private investors/companies who are interested in what's happening in the city. Since CDP has money, they also have more staff capacity to answer questions and walk through roadblocks if there are questions with the platform or COM requirements (they have a North American office and have called/emailed several times to follow up). The questionnaire allows you to save your progress page by page.

CONS: The platform questionnaire is more detailed and requires more time to fill out than Carbonn's. Although the topics covered are the same (GHG inventory, climate adaptation plan, climate action plan, city demographics/details), CDP goes into more specific details especially about the climate adaptation implementation (see Local Hazard Mitigation Plan for this). There is also an extra file for COM questions that somewhat overlap with the existing CDP questions. For future inventories/updates, CDP does allow

you to use the past uploaded answers. However, completing the questionnaire may still take a day or half day.

2.5 Carbon*n* Climate Registry (CCR)

carbon*n* Climate Registry (cCR). VOLUNTARY PLATFORM. The cCR is the world's largest reporting platform on climate actions and commitments and the designated repository for the Compact of Mayors, launched in September 2014. The GPC equips reporting cities to consistently measure and track their actions and make a credible case for accessing local and international climate financing.

PROS: The questionnaire covers the same material as CDP, but goes into less detail on the climate adaptation implementation component. ICLEI works with Carbonn, so eventually there will be a way to automatically upload the GHG inventory straight from ClearPath to Carbonn.

CONS: There are more specific questions about the different sectors and their scope1/2/3 GHG emissions. The platform support is harder to reach because they only have a base in Berlin. When the online submission form crashed, had to fill out an offline excel file instead, so this may make it harder to reuse old answers when it comes time to submit again next year. The online submission form also does not let you save within a section, so you need to have all the information completed for the entire section before submitting.